SCIENCE.

FRIDAY, MARCH 26, 1886.

COMMENT AND CRITICISM.

A REPORT FOR THE YEAR 1884 was made to the New York legislature early in 1885 by Prof. James Hall, state geologist: it was accompanied by a large preliminary geological map of the state, compiled by Mr. W. J. McGee, of the U. S. geological survey, from all available material which was of special value on account of its candid departure from the usual form of geological maps in coloring only those areas that had been pretty well studied, and leaving the rest conspicuously blank. There is no question that the publication of such a map would be an incentive to local investigation by explicitly pointing out where it is especially needed; and Professor Hall seems to have made this clear to the legislature, as it was ordered to be published by a resolution of the senate and assembly, and an appropriation was made for this purpose. But a note added to the report in November states that the governor has vetoed this item in the supply bill, and thus the appearance of the map has been indefinitely postponed, — a most regrettable piece of political economy. The same report contains a geological map of Ontario county, with accompanying text, giving a brief outline of its geological succession, by Professor J. M. Clarke. Apart from the valuable local details of stratigraphy, it excites our interest from the indication it gives of the true physical relations of some of the north and south lakes of western New York, — called the 'finger-lakes' by Chamberlin, — which the author refers to briefly as lying in separate preglacial valleys. When the ice of glacial times was breaking up in these valleys, "which had then had, no doubt, a long previous existence as valleys of water erosion," they discharged their waters into a basin where the town of Naples now stands, whence a southward overflow was found by the Conhocton River. A little distance west of Canandaigua Lake, another valley is shown on the map, now filled with alluvium, but equal in size to the average of those near by, now occupied by lakes. It would thus appear that the northern edge of the Devonian plateau of western New York is pretty well dissected by valleys of the ordinary type, in only some of which lakes are caught. The more numerous these valleys, the less aid need be called for from glacial erosion in originating them.

THE REPORT OF OBSERVATIONS of the annular eclipse of the sun, March 15–16, 1885, by Commander A. D. Brown and Ensign A. G. Winterhalter, U.S.N., has been issued as Appendix II. to the Washington observations for 1882. At least, we suppose that this appendix belongs to the volume of observations issued by the U. S. naval observatory, for it was received from the superintendent of that institution. The titlepage, however, simply states that it is 'Appendix II., 1882,' and the reader must learn from other sources to what publication it belongs. Unfortunately this omission, trivial in itself, is indicative of the character of the paper. It begins with a jerk, ends abruptly, and throughout resembles patchwork in which the pieces are fitted together with little regard for symmetry. Beginning with the preliminary circular calling for observations from volunteers in the north-west, it next describes the preparations for photographic work at Washington, and gives the number of plates exposed, with a few comments on the success attained. Then follow the contact and transit observations made at the observatory. Returning to the volunteers in the north-west, the authors give the reports in full, with two sketches showing the relative positions of the stations. The thread of the Washington narrative is then resumed (without the slightest intimation that the scene has been changed), the measurements of the photographs are given in detail, and a reproduction, by phototype process, of one of the negatives, closes the report. While the faults of arrangement are quite glaring, there are other defects which provoke criticism. Thus, two kinds of plates were used, collodion and gelatine, having different degrees of sensitiveness; but we are frankly told, though the reason therefor is not stated, that the slide was arranged for the former only, and that in consequence the latter were necessarily over-exposed. Again, the observations are only partially discussed, and we

are left in the dark as to their accuracy or utility. The reports of the volunteer observers show the lack of careful editing by the compilers. We are told at the beginning that the photographic work was undertaken at the request of Professor Newcomb, for certain investigations he was pursuing. It would have been wiser to have turned over to him at once the observations made, instead of publishing them in their present crude form. The publication is certainly not to the credit of the institution from which it proceeds. We should hardly have devoted as much space to the above report, had it not been published at a time when the status of the observatory is under discussion. If it indicates the character of the scientific work which is done by naval officers under naval management, the position of the committee of the National academy, that it would be unwise to build a new naval observatory, is amply confirmed. Contrast with this weak paper the appendix which precedes it in the same volume, — 'The orbit of Iapetus,' by Professor Hall, a model of scientific writing, — and further comment is unnecessary. The paper also emphasizes the need of a scientific head for the observatory. If under the present management such a publication is allowed to see the light, and thus make the institution the laughing-stock of the scientific world, it is time the management was changed.

THE PRIZE offered a year ago by H. H. Warner of Rochester, for 'the best three-thousand-word paper' on the brilliant sunsets of 1883–84, has lately been awarded. The judges were Professors Kirkwood of Bloomington, Ill., Harrington of Ann Arbor, Mich., and Stone of Virginia; and their opinion of the essays was so high that Mr. Warner was induced largely to increase the awards. Meteorologists will universally read with satisfaction that Kiessling of Hamburg received the first prize of two hundred dollars. Other prizes were given to J. E. Clark of York, England, H. C. Maine of Rochester, N.Y., and Rev. Sereno C. Bishop of Honolulu; the last is now well known in connection with his early observation of the new solar corona, which is now generally called after him. It is further stated in the Rochester *Democrat and chronicle*, that a 'special Warner medal of honor' will be awarded to Professor Abbe of the signal service, Professor Upton of Brown university, Prof. H. A. Hazen of the signal service, Professor Davis of Harvard college, Mr. F. Cowle of Lauriston, Tasmania, and Rev. R. Graham of Errol, Scotland. Mr. Warner's extension of his first offer of a single prize, so that there should be a more general recognition of the efforts made by a number of the competitors, is characteristic of his generosity, already well known to astronomers from his hundred-dollar prize for the discovery of new comets. It is said to be his intention to publish the sunset essays as soon as they can be put into shape for the printer.

A VERY GREAT INTEREST attaches to the brief notice of the new objectives of Dr. Carl Zeiss of Jena, by Dr. H. van Heurck, director of the botanical gardens at Antwerp. The success of Zeiss's experiments to discover a new glass which should give more perfect objectives than it is possible to make with crown and flint glass has apparently exceeded expectation, almost surpassed the highest hopes; for, according to van Heurck, the new homogeneous immersion $\frac{1}{8}$ objective, with a numerical aperture of 1.4, manufactured by Zeiss from the new glass, excels the best English lenses in the perfection of its sharp definition: "The images are of wonderful clearness, and the objective has a greater resolving power than any that we have had hitherto. With the vertical illuminator, Amphipleura argenteum is resolved into pearls, not merely at some points, but over the whole surface, and with such sharpness that they may be counted. No doubt this objective will show us, in many diatoms, details which have hitherto escaped observers. Bacteria will probably exhibit details of structure as yet unknown, and which will perhaps enable us to better differentiate the species." We have heard from other sources equal praise of the new objective, which seems to surpass the present much admired — we might almost say beloved — oil immersions, as these surpass the water immersions. It will be remembered that Professor Abbe, the son-in-law of Dr. Zeiss, pointed out, in 1878, that we could not hope for any considerable improvement in objectives until we should have some better materials than crown and flint glass. Since then the German government appropriated twenty-five thousand marks to enable Zeiss to make experiments in manufacturing new glasses suitable for lenses. All scientific men will rejoice that the experiments have had such a very successful result. We trust that the new objectives and oculars will soon be upon the market.

THE EUROPEAN COLONIES AND THEIR TRADE.

THE large commerce between Great Britain and her colonies has, especially within' the last ten or fifteen years, attracted the attention of the other European countries. They have watched with covetous eyes its steady increase and the rapid growth of the English mercantile marine, and have studied the policy which has either made the colonies of England self-supporting, or, where the expenses exceeded the revenues, pay tribute to London bankers in the form of interest at high rates on colonial loans.

Attempting to follow England's example, France and Germany have founded colonies, hoping to realize from them large commercial returns. Instead of this, the commerce with the colonies they have established has been very limited, and the outlays involved have imposed a heavy burden upon the home treasury. Even Algiers, the most prosperous of the colonies established by France, has been a constant and increasing expense. The attempt to establish a French colony in Madagascar has been abandoned, while that in Tonquin has only been maintained by the constant presence of a large army. The war with China, in which France became involved through the attempt to establish this colony, has caused a great drain on France, both of men and money; and, even at the present time, there is such a constant turmoil in northern Tonquin, that further demands of credit and fresh drafts of soldiers must constantly be made. This state of affairs will probably cause the overthrow of the ministry, if not of the republic; and the ministry have sought to avert their fate by sending M. Bert, a former minister of instruction, as governor, with full power in civil and military matters. It is asserted, and the facts seem to corroborate the statement, that the expense of maintaining the colonies of France, including the support of the required armies, largely exceeds the total value of the commerce, including both imports and exports; that the death-rate is in excess of the births; and that the French population is only maintained by draining France of her most enterprising citizens. These facts have become so overwhelming, that a party has recently been formed in France, advocating the abandonment of all her foreign possessions.

Germany recently took possession of an extensive territory on the south-western coast of Africa; but a rainless climate and a barren soil have proved insurmountable obstacles even to German thrift. Another German colony has been established on the east coast, west of Zanzibar, between the second and fifth degrees of north latitude, extending westerly into the interior. Several large rivers flow through this territory, rising in the mountain-range which separates the ocean from Lake Tanganyika. In the upland country the climate is probably healthy, and the soil rich. The Germans have also a small colony at Cameroon, on the west coast, under the equator; but here the natives have opposed the settlers, and their progress consequently has been slow. Of the commerce of German colonies, however, nothing is known, as no official returns have been published.

Italy has recently established a colony at Massowah, upon the Red Sea, with the result, thus far, of an increased deficit in the treasury. The Netherlands retains a part of its possessions in Asia; Spain and Portugal, a portion of the immense territory they formerly held in Africa and in America; and Denmark, her hold upon Greenland, Iceland, and three islands in the West Indies. The cost of maintaining these domains exceeds the revenue; but the deficit is small, and fully compensated by the commercial advantages derived from them. Belgium and Austria, on the other hand, have no foreign possessions. The Kongo Free States, which had their origin in Belgium, are a private enterprise of King Leopold II., and have been supported from his private purse. The cost of their maintenance has hitherto been very heavy, and must continue to increase, until the railroad around the falls between Vivi and Stanley Pool is constructed, allowing of the creation of trade with central Africa, and the consequent tax levies to defray the expenses of the undertaking.

Russia can hardly be said to have any colonies. The vast regions in Asia which have been settled by her people, willingly or unwillingly, should be looked upon as but natural expansions of her dominions; and little is known, either of their cost to the state, or the extent of their commerce.

Austro-Hungary alone, of the European countries, remains to be considered, and that kingdom is little more than a congery of colonies. Eleven different languages are spoken within its borders, and the people of this heterogeneous empire have

no desire to colonize other regions than those taken from Turkey.

The following tables are of much interest. They show that eighty per cent of the colonial territory held by Europe belongs to Great Britain, that over eighty per cent of the entire commerce is with Great Britain, while the territory of its colonies is sixty times as large as that of Great Britain itself.

Territory.

Countries.	Surface in square kilometres.			Per-centages.	
	Mother-country.	Colonies.	Total.	Moth. coun.	Col's.
England...	312,639	20,552,574	20,865,213	1.5	98.5
Portugal..	89,297	1,827,259	1,916,556	4.7	95.3
Netherl'ds.	32,745	1,767,748	1,800,493	1.8	98.2
France	528,393	990,825	1,519,218	34.8	65.2
Spain.....	499,570	429,085	928,655	53.3	46.2
Denmark..	35,686	225,564	261,250	13.7	86.3
Total....	1,498,330	25,793,055	27,291,385	5.5	94.5

Population.

Countries.	Population in 1881.			Per-centages.	
	Mother-country.	Colonies.	Total.	Moth. coun.	Col's.
England...	35,153,780	213,918,000	249,071,000	14.1	85.9
Netherl'ds.	4,172,991	26,841,597	31,014,588	13.5	86.5
France	37,672,048	8,722,857	46,394,905	81.2	18.9
Spain.....	16,350,874	8,175,467	24,526,341	66.7	33.3
Portugal...	4,160,315	3,723,967	7,884,282	52.8	47.2
Denmark..	1,969,045	127,122	2,096,167	91.8	8.2
Total....	99,479,053	261,509,010	360,988,063	27.6	72.4

Trade.

Countries.	Commerce of the mother-country.	Commerce of the colonies with the moth.-country.	Colonial commerce compared to the commerce of the mother-country in percentages.
England	17,884,275,000	4,658,950,000	26.00
France	10,636,500,000	526,400,000	4 95
Netherlands...	4,428,450,000	200,200,000	4.50
Spain....	1,371,150,000	128,800,000	9.39
Denmark.....	598,950 000	22,500,000	2.46
Portugal	391,950,000	7,925,000	2.02
Total.....	35,311,275,000	5,544,775,000	15.70

GARDINER G. HUBBARD.

THE U. S. GEOLOGICAL SURVEY.

AS a part of the evidence before the commission considering the organization of the government scientific bureaus, there was recently presented a letter from Mr. Alexander Agassiz, in which he took occasion to censure the work of the geological survey, and to condemn to some extent its existence as a government institution.

One question raised by Mr. Agassiz is whether the work carried on by the survey should not be left to individual enterprise. In answer to this, Major Powell, in a reply addressed to the commission, calls attention to the large expenditures required for such work, and adds, that he has no knowledge of any case where private institutions, such as colleges or societies, have undertaken to do field-work in topography and geology. To some extent individuals, notably a few college professors, have made geological excursions in the field, and have accumulated valuable material.

The principal publications in this country on geology and paleontology, however, have contained the results of investigations carried on at the expense of the general or state governments; and the publication of such results, on account of the cost of the plates required, is far beyond the resources of private institutions. To show the relation between the official publications and those at private expense, Major Powell presents some figures collected from the material in the library of the geological survey. They do not represent the entire body of publication, but it is believed that they fairly give the ratio of official to private matter. These figures show 105,775 pages on general geology published by the government, to 15,139 pages published by private parties. The ratio of geological maps is about the same; and, comparing the amount of governmental with the amount of private publications in paleontology, the ratio of number of pages is 18,151 to 13,916; the number of plates being as 2,858 to 769.

The publications of the survey contain the writings of nearly all our best geologists; and it is thought by Major Powell that a wide distribution of its scientific reports, placing them at the disposal of one or two libraries in each county in the country, would tend to make the results of the investigations as available as they should be.

It has been especially fortunate for the survey that there exists in the Comstock, Eureka, and Leadville mining districts vast shafts and galleries which have allowed of an unparalleled study of problems in economic geology; and great credit is due to the survey for having taken advantage of these opportunities. As the law establishing the

survey especially requires that economic work should be done, and as the primary function of the survey is the performance of such work, it is evident that this class of investigation has been carried on strictly in obedience to the law, and in fulfilment of its purpose.

The annual output of the mines of the United States aggregates in value about $425,000,000; and, while the economic results of the survey have largely been devoted to this industry, the needs of the agricultural community have not been forgotten. At present investigations are going on of the flood-plain valleys of the great rivers, like that of the Mississippi, for the purpose of determining the conditions under which they can be redeemed; and, on the other hand, of the great arid regions, to determine by what means they may be more economically fertilized by irrigation; and, again, of the coast marshes and interior swamps, to learn the possibility of their utilization by drainage. In the prosecution of its topographical work, the survey is constructing a map of the forests of the country; and in its study of the structural geology it is revealing the conditions under which artesian wells may be discovered, and prognosticating the areas where such wells may be constructed. In the study of the interior hydrography of the country, the survey is developing the conditions under which our towns may obtain a supply of healthful water; and, in this connection, the calls upon the survey for information are many and rapidly multiplying. It is hardly necessary to add, that, in the construction of a topographic map of the United States, the people are supplied with a knowledge of the natural routes for the highways of commerce. It will thus be seen that the work of the survey has practical relations with all the industries of the people, and that it is pre-eminently designed to promote their welfare.

THE RAILWAY TO CENTRAL ASIA.

UNDER the direction of General Annenkoff, the Transcaspian railway has made remarkable progress. At the beginning of the present year it extended from Mikhailovsk, on the bay of the same name, to Ghiaurs, a small station some miles beyond Askabad. From thence to Merv the road-bed is finished, and the stations and bridges are constructing. It is expected that trains will run to Merv this spring, and that by midsummer the road will be completed to the Amu Daria at Charjui, a total distance of one thousand and forty-one kilometres. The harbor at Mikhailovsk is very shallow, and the deep water at Krasnovodsk is too distant; but another spot has been found, twenty-four kilometres from Mikhailovsk, where, by a moderate amount of dredging, the largest vessels of the Caspian can come up to a jetty now building. For the other end of the line, to connect with the railway, steamers of a special type are being constructed, suited to cope with the swift and shallow waters of the Amu Daria. The difficulty presented by drifting sands in the desert is to be met by introducing plants, already tested for such purposes in the arid regions of Algeria; and at the principal stations large quantities of them are already being set out in propagating-houses.

This enterprise is a military road, built and designed by officers of the war ministry, assisted by soldiers, Tartars from the Caucasus, and Turkomans and other inhabitants of the region. The chief difficulty has not been the sands of the desert, but the want of water; the existing wells being far apart, brackish, and hardly sufficient for the ordinary purposes of the caravans. However, it has been determined by experiment, that, at a certain depth in the soil, water exists in sufficient quantity, and increases at greater depths. Artesian wells will therefore be dug, the machinery for which is already on the ground. The worst part of the line determined upon is the desert which extends some two hundred kilometres eastward from the Merv oasis. This, though arid and sandy, produces a growth, sometimes almost a wood, of the 'saxaul' (Haloxylon ammodendron) and other nearly related shrubs, which only disappear at a distance of some forty kilometres from the Amu Daria.

After passing the lesser desert near Mikhailovsk, and reaching the station at Kizil Arvat, the railway takes a direction parallel to the Kopeth range, which coincides with the borders of Persia. It crosses the Akhal oasis, and passes under the walls of Geok Tepe a few yards from the spot where the assault was made by which the fortress was carried. The most important station is Askabad, a flourishing town only three years old, but already enjoying an important commerce with North Khorassan. Farther on, the line passes the Persian village of Lutfabad at a distance of two kilometres, and enters the Attek oasis, now beginning to revive under the security afforded by Russian rule. Duchak, at 391 kilometres from Kizil Arvat, is the most southern point of the line, from which diverge the routes to Séraks, Heshed, and Herat. Here the road turns toward Merv, and enters the desert in a north-westerly direction. There are no brooks or springs, but from the mountains to the south-east come two rivers of importance, — the Tajand or Hari-Rud, and the Murghab. The former is dry in winter, but in summer has twice the volume

of the Murghab. To the north-west both rivers are lost in the sands of the desert. The Hari-Rud is crossed by a bridge ninety-seven yards long. From this point it was formerly a distance of ninety kilometres to the nearest fresh water, but this has been diminished to forty-eight kilometres by a canal constructed by Colonel Alikhanoff during the past season. This diverts part of the water of the Murghab, but it was found impracticable to extend it further. The latter river, unlike the Hari-Rud, does not dry up, but carries in winter seventy-five cubic metres per second as against three hundred in summer. It contains about two per cent of earthy matter, amounting, for the annual epoch of floods, to about fifty million cubic metres of mud, which is spread by the innumerable irrigating canals over the surface of the Merv oasis. The destruction in 1784, of the great dike of Sultan Bend, much diminished the irrigated and fertile area. The Russian government has reserved sixty thousand rubles to rebuild this dike, and it is expected that nearly four hundred thousand acres will be reclaimed by this work, and, in time, nearly four times as much more. This land, when irrigated, is of extreme fertility, wheat producing a crop of one hundred bushels for every bushel sown. Merv is growing rapidly: town lots of a certain size are given away, on condition that the receiver builds upon them at once. The streets are wide, with broad footwalks, planted with trees, and bordered with small canals. The oasis is confidently expected to develop largely in the near future.

PHOTOGRAPHIC STUDY OF STELLAR SPECTRA.

THE study of stellar spectra by means of photography was one of the most important investigations undertaken by the late Prof. Henry Draper. He was actively engaged in this research during the last years of his life. His plans included an extensive investigation, one object of which was to catalogue and classify the stars by their spectra. Mrs. Draper has made provision, at the observatory of Harvard college, for continuing these researches as a memorial to her husband. The results already obtained, with the aid of an appropriation from the Bache fund, permit the form of the new investigation to be definitely stated. The part of the sky to be surveyed is that extending from the north pole to the parallel of thirty degrees south declination. Each photograph will be exposed for about one hour, and will include a region ten degrees square. The telescope employed has an aperture of twenty centimetres (eight inches), and a focal length of a hundred and seventeen centimetres (forty-four inches). The object-glass is covered by a prism, and the resulting spectrum of each star in the region photographed has a length of about one centimetre, which enables the character of the spectra of stars from the fifth to the eighth magnitude to be determined. A modification of the apparatus is employed for the brighter stars.

Meanwhile, experiments are in progress with the fifteen-inch equatorial, with the object of representing the spectra of some typical stars upon a large scale. The spectra so far obtained are about six centimetres in length, and exhibit much well-defined detail. Additional experiments will be tried with a spectroscope provided with a slit, as well as with the simple prism hitherto employed, in order to secure the best possible definition. The present results encourage the expectation that the movements of stars in the line of sight may be better determined by the photographic method than by direct observations.

To keep the astronomical public informed of the progress made in this work, specimens of the photographs obtained will be gratuitously distributed from time to time. The first of these distributions will probably be made in a few weeks. Owing to the expense of providing a large number of copies, it is desirable to limit the distribution, so far as possible, to those who are interested in this class of work. It is also desired, however, to send the specimens to all who will find them of value from the scientific point of view. Requests should be sent to the Harvard college observatory by any one desirous of receiving the specimens. EDWARD C. PICKERING.

THE HUDSON BAY ROUTE TO EUROPE.

LAST year there appeared in *Science* (vol. v. No. 110) an account of the Hudson Bay expedition of 1884, accompanied by a track-chart showing the route followed. Lieutenant Gordon's official report of his last summer's trip to the bay, to relieve the observers at the stations established in the strait in 1884, is included in the annual report of the Canadian department of marine, lately submitted to the Dominion parliament. It is in narrative form, and contains little new information, the results of the observations conducted at the several stations being reserved for publication as a separate report so soon as they shall have been reduced to proper form.

Lieutenant Gordon, after promising details of the observations at an early date, concludes his report with the following remarks on the prospects of navigating the strait: "The reports go to show that the ice set fast in the western end of

the straits during the last week of October, 1884, and that for all practical purposes of navigation the straits remained closed at this point till the early part of June in the present year. In June a good deal of open water was seen at different times, but the pack would close up again, and remain in that condition for several days at a time.

"From a consideration of these reports, I am of the opinion that it might have been possible to pass through the straits during the early part of this July. The same date of closing as shown by the observations last year would give a season of navigation rather less than four months for the individual season.

"It should, however, be stated, that the movements of ice this spring were evidently much later than those of last year; for in the month of August this year we met with vast quantities of heavy ice, and in the same month last year comparatively little was seen. On the Labrador coast and at Churchill the report was the same, — that the ice was unusually late in leaving this year.

"I was informed by a captain who had made a number of voyages through Hudson's Straits, that he had seen the straits clear of ice in June, but that it was a rare occurrence. The fact, however, that the straits had been clear at this time, shows that there is a great variability in the dates of the opening of navigation."

The above conclusions scarcely seem to justify the building of a railway from Winnipeg to Churchill, — a scheme so seriously contemplated, that one or more companies have been organized, an extensive preliminary survey made, proving the feasibility of the route, and the requisite capital actually promised; while one of the engineers has gone so far as to assert that the bay and strait were navigable for properly constructed vessels all the year round.

The observers at all the stations report that the huts were warm and comfortable, the food good and sufficient, and their health, except in the instances mentioned, excellent. The weather was not nearly so severe as expected, the thermometer never going so low as it often does in inhabited portions of the north-west.

THE PANAMA CANAL.

IT has been reported in the daily papers from time to time, during some months, that matters at the Isthmus of Panama were in a bad shape, that the funds previously subscribed and loaned were nearly exhausted, and that but a small portion of the necessary excavation had been completed. Apparently to counteract the impression made on the public mind by these statements, M. de Lesseps, on his brief visit of inspection of the work in progress on the canal, from which he has just sailed for France, was accompanied by delegates from various commercial cities of Europe and this country, and an engineer was also despatched by the French government to report upon the state of affairs, before a decision should be made in regard to the advisability of allowing a further sum of money to be raised and borrowed for the canal.

In the supplement to No. 148 of *Science* (vol. vi.) there appeared a notice of the recent book by J. C. Rodrigues, on the Panama canal, which, from his point of view, showed that the canal construction had been shamefully mismanaged from the start, and that failure and bankruptcy were imminent. There has just issued from the press another work[1] on the same subject, written by one who has had a large, if not the largest, share in the preliminary investigations, in the deliberations of the canal congress, and in obtaining the territorial and other concessions, and has had the best of opportunities for knowing about the progress of the work, — Commander Lucien N. B. Wyse. As will be inferred from the sub-title, the author aims to give an exhaustive account of the matter, from the very earliest explorations, through the discussion of the several proposed routes, a critical analysis of the points for and against the eleven most promising lines, an account of the political and business negotiations with other countries, the concessions secured, and the views and arguments of the United States authorities, down to the present state of the work (October, 1885), the money already expended and the future prospects. The admirable map which Commander Wyse gives, of that portion of Central America and the isthmus in which lie his several projected routes, is reproduced with this issue of *Science*, and the accompanying profiles show in metres the elevation of the ground over the different lines. The book contains also a plan of the Panama canal as it is to be when completed, and some ninety woodcuts of isthmian scenes and views of the canal-works.

The volume is very handsomely printed; and a person, whether interested or not in the canal, will find the opening portion, describing the scenery, the flora and fauna, the geological formations, the climate, the inhabitants, and the mode of life in that part of the world, very readable. Space will not permit the giving of an ab-

[1] *Le canal de Panama, l'isthme américain; explorations; comparison des traces étudiés; négociations; etat des travaux.* Par LUCIEN N. B. WYSE. Paris, *Hachette*, 1886. 8°.

stract of his account of the explorations, in which many parties were occupied for a long period and over a great extent of territory. Nor can more than mention be made of the eleven plans, by different explorers, discussed in detail : viz., —

1°. By Commodore Shufeldt and Mr. Fuertes, at Tehuantepec, 280 kilometres, all to be excavated, and 140 locks.

2°. By Childs, revised by Commandant Lull and Mr. Menocal, at Nicaragua, 292 kilometres, 195 of which are to be excavated, Lake Nicaragua and 21 locks.

3°. By Commandant Lull, at Panama, 72 kilometres, all to be excavated, with 25 locks and a canal-bridge over the Chagres River.

4°. By Wyse, Reclus, and Sosa, at Panama, 75 kilometres, all to be excavated, a sea-level canal, with or without a tunnel, and now under construction.

5°. By Wyse, Reclus, and de Lépinay, at Panama, 72 kilometres, 50 of which are to be excavated, with 11 locks and an artificial lake in valleys of Chagres and Rio Grande.

6°. By McDougal, Commandant Selfridge, Wyse, Reclus, and Sosa, at San Blas, 53 kilometres, 42 of which are to be excavated, level canal with tunnel of 15 kilometres.

7°. By Wyse, etc., at Darien, 125 kilometres, 74 of which are to be excavated, level canal with tunnel of 17 kilometres.

8°. By Wyse, etc., at Darien, 235 kilometres, 128 of which are to be excavated, with 22 locks and tunnel of 2 kilometres.

9°. By Trautwine, Kennish, Michler, etc., at Choco, 210 kilometres, 90 of which are to be excavated, level canal with 2 tunnels of 3 and 8 kilometres.

10°. By Commandant Selfridge and Mr. Collins, at Choco, 290 kilometres, 50 of which are to be excavated, with 22 locks and tunnel of 6 kilometres.

11°. By the same, the same, modified to 2 locks and tunnel of 6 kilometres.

It will be interesting to see how the author's opinions of the past conduct of the work on the canal, the present material and financial condition, and the future prospects for completion, compare with the views of Mr. Rodrigues, already referred to. But in weighing the statements it will be well to bear in mind that the author has written this book, as he states in his dedicatory letter, to establish the facts for his family's sake, that he was the originator of the plans and route adopted, and the negotiator of the concessions obtained, — facts which otherwise seemed likely to be obscured by the strong personality of de Lesseps. He desires also, by presenting his original plans, to absolve himself from blame for errors committed by others. He acknowledges that between the session of the Paris congress in 1879, and the organization of the canal company in 1880, a coldness sprang up between M. de Lesseps and himself, and that his appointment as director-general was withdrawn.

He states, that, in order to have some official acquainted with the business in hand, the place of superior agent at the isthmus, with duties but poorly defined, was given to his old friend and collaborator, M. Reclus, who initiated the enterprise in January, 1881, began the clearing, the final studies, the assembling of plant, buildings, etc., built a large landing at the north entrance, and erected a general hospital at Panama. He was succeeded in June, 1882, by M. Verbrugghe, and later by M. Richier, under whom was begun the first digging of the canal proper. This administration was not a success ; and when, in 1883, M. Dingler was appointed director, he abolished the office of superior agent. The oversight of the work, already too negligent, became quite inefficient ; and to-day, four years and a half from the beginning, matters are in a bad shape. The appointment of Engineer Hutin, first as subdirector and then as chief engineer, is not sufficient, despite the good-will which he brings to his position, to remedy the evil already done.

In October, 1885, the following was the state of affairs : there has been moved a total of from sixteen to seventeen million cubic metres of earth, twelve millions only being from the canal proper, and eighty-eight millions are still to be excavated. Besides, there have been prepared buildings and stables on an extravagant scale, farms and gardens at great expense around headquarters, railroad branches, field hospitals, and roads, three of which he says are of but little use except for pleasure-riding by idle employees. Considerable labor has been expended on the Atlantic side. The best organized works are at Emperador ; while at Culebra, a very important section, as will be seen by the profile, the reverse is the fact, and the amount already excavated is far out of proportion with the vast quantity which yet remains in place. On the Pacific slope the work is less advanced. He claims that at Culebra, by an injudicious deviation from his line, the management has increased the depth of cut from eighty metres to a hundred and nine metres. A vast quantity of tools, machinery, and materials, has been collected, and some fine workshops have been organized. Many of the excavators and dredges have caused trouble, delays, and breakdowns, while difficulties with the temporary tracks and cars for moving earth are frequent. The question of the protection of the canal from the dangerous floods of the Chagres River by means of a dam and large storage-reservoir has not been settled in the last three years. What he thinks of the present management may be inferred from his expression, *une administration méticuleusement paperassière.*

The company has received half of its capital stock, a hundred and fifty million francs, besides four hundred million, in round numbers, in obligations of three different types. It has on hand

something over sixty million francs, and the remaining half of its capital, with which to pay for the excavation of eighty-eight million cubic metres. From eighteen months to two years have been lost through lack of discipline and ill-directed efforts. If we judged only from the earth already moved, there would be required to complete the work four thousand million francs and thirty-six years. But the expense and time spent in getting ready, the acquisition of property, and the collection of materials, must be considered. There have been wasted in useless works, too high prices, and absurd contracts, a hundred and fifty million francs. The errors committed by the direction will amount, at the time of completion, to a loss of about three hundred and fifty million francs, to which ought to be added a large share of the ninety-four million francs paid for the Panama railroad, since the better terms he had negotiated with the railroad company were set aside.

He still adheres to and defends his original estimate of a hundred and five million cubic metres of earth as the quantity needful to be moved, provided the useless plans for the deviation of the Chagres, and the formation of a great interior port near Corrozal, are given up. The treatment he would apply to the river is that of one large dam and a number of smaller ones along its course. The earth has proved of good quality for retaining a slope, is deeper, and there is less rock and of a less hard nature than was anticipated. By a reformation of methods of administration and work, by the employment of experienced contractors, by carrying out no unnecessary projects, by push and energy, he estimates that it is possible to finish the canal in six years. The company must raise, for the eighty-eight million cubic metres of excavation, at five and a half francs per metre, four hundred and eighty-four million francs, and seventy-five millions for accessory works, and one hundred millions for discount, interest, etc., less certain savings which can be made; in all, about six hundred million francs. By proper and rigorous economy he believes that the total cost can be brought to twelve hundred million francs.

We find, further, that he calls attention anew to his alternative project at Panama, with ten or eleven locks, the fifth in the preceding enumeration, as offering a cheaper and a quicker solution of the problem in which the company is now engaged. Current rumor would seem to indicate that the company was leaning towards such a way of extricating itself from its present difficulties, even with an abandonment of the chief argument in favor of the Panama route, — that it would be a sea-level canal like the Suez canal, without locks.

He closes with a discussion of the mercantile advantages to be derived from the canal, and the revenue from which to repay the great outlay cited above.

LONDON LETTER.

IN the first of this series of letters, allusion was made to the frightfully unsanitary condition of the river Lea, in one of the London suburbs. From the upper part of this, water is still drawn for the metropolitan supply, while enormous quantities of sewage, etc., are allowed to drain into it lower down in its course. A few days ago a public meeting was held at the Mansion house, London, under the presidency of the lord mayor, in aid of the "National society to secure effective legislation against river-pollution." The attorney-general, Sir C. Russell, M.P., moved the following resolution: "That the speedy purification of our rivers would, in the opinion of this meeting, effect a great reform long urgently needed, and of vital importance to the general health and welfare of the community." There were two defects in the existing law: first, it was only permissive instead of compulsory; second, its powers could only be put in force by the sanitary authorities, who in some instances had been the main offenders. He would like to see the law so amended that no sewage-pollution should be allowed, under any circumstances, to enter any river, — at least, up to the point of its reaching the sea or a great estuary, — and he did not think the difficulty of making the law effective to that extent would prove very serious. Reform in the case of the river Lea would be a pioneer of reform in the case of other rivers; and, if the responsibility of dealing with sewage were placed on communities, the question would very soon be settled. From what came under the notice of the present writer during his recent visits to America, he thinks these weighty words should not be without due warning to various parts of the states and Canada.

The exceptional length and severity of the present winter are universal topics of conversation. For some days there has been skating in the London parks, — an event without precedent, for the second week in March. On the nights of Saturday and Sunday, March 6 and 7, the minimum temperature registered by screened thermometers (verified at Kew) near Stoke-on-Trent, in the midland districts of England, was 7° F. The next lowest temperature recorded in March was 13°, on March 13, 1845; and, according to Mr. Glaisher's Greenwich tables, that was the coldest

day for the sixty years from 1814 to 1873. Over the greater part of the British Islands, this February was one of the coldest Februarys on record; the Greenwich mean being 33°.8, or 6°.8 below the average, while through Great Britain generally, from the Grampians to the Channel, the mean temperatures were from 5° to 7° below the monthly averages. Severe snow-storms blocked the lines on the east coast in the first few days of March, and also in North Wales, as many as thirty trains being snowed up between Newcastle and Berwick alone.

It has long been observed, that, for every degree below the average temperature in any week, a definite increase takes place in the average number of deaths, chiefly among elderly people. Among recent victims, two may be mentioned, — the famous Scotch naturalist, Mr. C. W. Peach, who was a most remarkable example of the irrepressible instinct of a true lover of nature; and Dr. Storrar, for many years chairman of convocation of the University of London. To him the medical graduates of that university owe far more than most of them are aware of. In the early days of the university, nearly half a century ago, its degrees were, for various reasons, looked on with much suspicion, and the other medical bodies in authority were inclined to deny any status whatever to the new graduates; in fact, attempts were made to prevent them from engaging in ordinary medical practice. Dr. Storrar sacrificed his own professional prospects in order to fight this question, and at the present day the London university degrees in medicine rank as the highest which it is possible to obtain.

The engineering tripos at Cambridge, alluded to in a former letter, has now been fairly established, and the chief regulations in connection therewith appeared in the university intelligence of the *Times* a few days ago. Inquiries as to the desirability of establishing degrees in engineering have been issued on behalf of the University of London.

The annual report of the director of the French agricultural department on the proceedings of the Phylloxera commission has just been published. It has been decided that none of the processes made known during the year 1885 entitle the inventors to the prize offered by the government, and accordingly the old remedies continue to be recommended. These are, 1°, submersion, which was applied in 1885 to 24,329 hectares; 2°, carbon disulphide, to 40,585; and, 3°, potassium sulphocarbonate, to 5,227. American vines which have been planted now replace those destroyed, over a surface of 72,362 hectares. The surface which has resisted the attacks of the insect is about twenty-two per cent of the whole surface suffering from the disease.

The hydrophobia scare is still sufficient to keep the muzzles on the unfortunate dogs. Questioned last night in the house of commons by Sir Henry Roscoe on the subject of M. Pasteur's cure for this terrible disease, Mr. Chamberlain replied, on behalf of the government, that he hoped to be able to arrange for such an investigation as would enable a just estimate to be formed of M. Pasteur's method, and its applicability in this country. In a recent paper read before the French academy of medicine, M. Pasteur gave details of three hundred and fifty cases, all of which, with one exception, he had treated successfully; and he has, whenever possible, secured certificates from doctors and veterinary surgeons as to the existence of rabies in the animals concerned. M. Pasteur hopes soon to turn his attention to diphtheria.

W.

London, March 13.

VIENNA LETTER.

THE struggle between gas and electricity as means of lighting has reached a new stage in the invention of Dr. Auer of Welsbach, Austria, a young Vienna chemist who has been experimenting at Professor Lieben's laboratory. The principle of Dr. Auer's invention is no new one. Every one knows the Drummond light, in which a cylinder of lime is brought to incandescence by a burning mixture of hydrogen and oxygen. But, in all previous attempts of this kind, a temperature was required too high for ordinary use. Dr. Auer has found a substance — the composition of which he unfortunately keeps a secret — which becomes incandescent at the temperature of a Bunsen burner. His lamp consists of such a burner, surrounded by a common lamp-cylinder, in the flame of which is hung a hollow cylinder of thin 'organtine' impregnated with a metallic salt solution. By the action of the flame, the organic matter of the 'organtine' is destroyed; the salt is converted into an oxide; and a white, very elastic, porous cylinder remains, which becomes incandescent. Dr. Auer's lamp has given, according to recent measurements, a luminous power of twenty candles at a gas-supply of fifty-six litres per hour.

A very important discovery, both for practical and theoretical medicine, has been made here by Mr. Ernst Freund, a pupil of Prof. E. Ludwig, at Professor Stricker's laboratory. From earlier experiments, it is known that blood does not coagulate so long as it is contained within the living healthy vessels; though clotting occurs whenever the vessels are injured, or have lost their vitality,

according to experiments made by Durante and by Zahn. In a short time (in man in three minutes) after the blood is withdrawn from the veins, or after death, coagulation of the blood commences. Coagulation can be hindered or suspended in various ways, such as contact with living healthy vessels (Lister, Bruecke), exposure to low temperature (at 0° C.), or by the addition of solutions of certain neutral salts (sodium chloride, sulphate, carbonate; magnesium sulphate, etc.). If peptone is mixed with the blood, its clotting is suspended; and Dr. Haycraft of Edinburgh has kept it fluid for a longer time by adding an aqueous extract prepared from the intestines of leeches. It may be also noted that a German physiologist, Professor Gruenhagen, some time ago observed that blood, if collected in glycerine, remained fluid so long as a mixture did not take place.

Now, Mr. Freund has found a very simple method to prevent the coagulation. He collected the blood, drawn from the vein of an animal, under oil, and it remained fluid for many days. In further experiments it was found, that, in arterial blood collected in a glass vessel whose walls were continuously coated with a film of vaseline, the fibrine did not separate, even when stirred or agitated with a vaseline-coated glass rod; but, as soon as the blood was poured into an ordinary receptacle, the fibrine was immediately coagulated. It was further observed by Freund that the presence of minute foreign bodies, such as particles of dust, was sufficient to produce clotting. These experiments were made, both at ordinary temperatures and at that of the body, with equal success. In one of the experiments which I had the opportunity of seeing, a glass tube coated with oil was inserted into the carotid artery of a dog, while a dry tube was connected with the crural artery of the same animal. The blood in the latter was clotted in fifteen minutes; but the pulsations of the blood column in the oiled tube were perceptible for more than two hours and a half. Fresh blood contained in fish-bladders, or parchment tubes, which had been previously soaked in a 0.6 per cent solution of chloride of sodium, and afterwards covered with a like solution, remained fluid for many days.

Mr. Freund has made a preliminary communication on his researches, which will be continued in an early number of the *Wiener medicinische jahrbücher*.

V. C.

Vienna, Feb. 16.

NOTES AND NEWS.

THE teachers' course in chemistry at Harvard during the summer of 1886 will be under the direction of Dr. Comey, and will open July 5, and close Aug. 14. Instruction will be given in general chemistry, qualitative analysis, quantitative analysis, and organic chemistry. A course in mineralogy will also be given. The fee for the course is twenty-five dollars. An additional charge, which has averaged from five to six dollars, is made for the material and apparatus consumed by each student. The summer classes are offered the same facilities for laboratory work as are open to students during the academic year. The college library is open for the use of students in these courses. For further information address Arthur M. Comey, Harvard chemical laboratory, Cambridge, Mass.

— On the 23d of September, 1882, Friedrich Wöhler died, in his eighty-third year, one of the last and one of the most eminent of the chemists whose lives and labors connected the early formative age of the science with that of its recent wide expansion. As investigator and teacher, as author and scientific correspondent, he deserved, as few have done of those who have passed away in our time, that his memory be held in honor by those who care for the science of chemistry. Soon after his death a movement was begun in Germany, originating with the German chemical society, for the collection of an adequate sum of money with which to erect in Göttingen a statue to Wöhler, as a permanent monument, on the spot where most of his life's work was done. The subscription has reached the sum of about four thousand dollars, but this is not yet sufficient for the purpose in view. The co-operation of American chemists has recently been asked by a member of the local committee in Göttingen, in a letter addressed to one of the undersigned, who have formed a committee for the United States in order to give practical shape to action in this country. Contributions may be sent to any one of the following: James C. Booth, U. S. mint, Philadelphia; J. W. Mallet (chairman), University of Virginia; C. F. Chandler, Columbia college, New York; H. B. Nason, Rensselaer polytechnic institute, Troy; F. Frerichs, Mallinckrodt chemical works, St. Louis; Ira Remsen (secretary and treasurer), Johns Hopkins university; Wolcott Gibbs, Cambridge; W. B. Rising, University of California, Berkeley; E.P. Harris, Amherst, Mass.; S. P. Sadtler, University of Pennsylvania, Philadelphia; J. W. Langley, Ann Arbor; C. U. Shepard, jun., Charleston, S.C.; F. Mahla, corner 21st Street and Stewart Avenue, Chicago; Eugene A. Smith, University of Alabama, Tuscaloosa.

— Four additional sheets of the New Jersey topographical map are lately issued, making ten

now published out of the total seventeen. The unfinished sheets cover the inland area of the state, along the lower Delaware. The arrangement of the map sheets was illustrated in *Science* (vii. No. 155). A map of the whole state, five inches to a mile, will form an eighteenth sheet.

— The fifth annual report of the U. S. geological survey, just issued, contains a number of valuable works by well-known authors, and is richly illustrated by excellent engravings. In addition to the papers already noticed, there is one by Prof. O. C. Marsh, on the gigantic mammals of the order Dinocerata, — an abstract of his volume on the same subject, already published, — and one by R. D. Irving, entitled "Preliminary paper on an investigation of the archaean formation of the north-western states," which contains the results of field and laboratory investigation of the problems of correlation, structure, and genesis.

— Professor Koch of Berlin is issuing a *Zeitschrift für hygiene*, for the publication of his own researches, which have hitherto been made public in the official documents of the imperial health office, as well as for the publication of the results of investigations undertaken under his direction in the Hygienic institute lately established in connection with the university.

— After many denials, it is again authoritatively announced that Professor Du Bois-Reymond is at work on a history of natural science in the nineteenth century.

— The strips of papyrus that were taken from an Egyptian excavation several years ago, and placed in the Berlin museum, are said to contain parts of the great work of Aristotle on administration, and, in particular, passages from the most valuable part of that work, — that treating of the civil administration of Athens.

— J. H. Darwin, son of the late Charles Darwin, is understood to have his father's biography nearly ready for publication. It is believed that the book will contain much of interest concerning the naturalist's domestic life. and his methods of carrying on his investigations and researches.

— At the last meeting of the Academy of political science, Columbia college, Hon. John Jay Knox, ex-comptroller of the treasury, read a valuable paper on 'Legal tender in the United States.' It is not improbable that Mr. Knox's paper will be published in an early number of the new *Political science quarterly.*

— The annual report of the Connecticut agricultural experiment-station, for 1885, deals almost wholly with analyses of feeding-stuffs and fertilizers. The laws of Connecticut require analyses to be made of all commercial fertilizers annually. The results of such, accomplished at this station in past years, have been of real value to the farmers and gardeners throughout the state. The larger part of the matter upon food-stuffs is compiled, though evidently useful. The original portion, however, is not inconsiderable. In these reports one is impressed with the almost purely chemical nature of the work accomplished; and the *personnel* of the station is composed wholly of chemists. While there can be no question of the great importance of agricultural chemistry, it certainly seems that the work of an agricultural experiment-station should not be so exclusively limited. One must think that a botanist and entomologist would be a desirable accession to the already able staff.

— Messrs. Romanoffski and Mushketoff have published a geological map of Russian Turkestan in six sheets, on a scale of 1 : 1,260,000. Besides surface geology, this chart shows the area occupied by ancient and modern glaciers, the location of mines, and the altitude of all important points.

— There have been received to date at this office the following subscriptions to the Heer memorial: Prof. Jules Marcou, five dollars; Prof. Asa Gray, five dollars; Mr. S. H. Scudder, five dollars.

— The next annual session of the National academy of sciences will be held in Washington, at the national museum, commencing Tuesday, April 20, at 11 A.M.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Certain questions relating to national endowment of research in this country, and their importance.

We have before us for our consideration at the present time, in this country, a number of questions of the highest import to science, of which it may be said that they are as yet in a formative stage. By this is meant, that the United States, as now representing one of the distinct nations of the world, has not yet expressed a national opinion upon them, after the manner usually adopted by nations for expressing opinions which may be said to be national, and which the nation stands willing to defend in opposition to the opinions of other peoples. Of the several questions that I refer to, none can claim greater weight than that one which takes into consideration the extent to which our government should endow scientific research.

This is really a point in political economy of the utmost importance, as it affects the national welfare, and has much to do with the formation of the national character. To those who have watched the growth. and approach towards a decision, of this issue during the past twenty-five years, the fact

must now be evident that we have arrived at that point when we must soon decide upon the attitude we are to assume in regard to it.

When all the elements of civilization have been in operation for over a century in a new country like ours, and when we come to study the final result, there is no better criterion of the success of that civilization than the relative number and the eminence of the leaders in the sciences, arts, and industries that it has produced.

We have many such leaders, and they must be regarded as the best fruits of our civilization; while their works, or the effects of their works, will always measure the degree of respect that we are held in by other nations.

To-day the problem which is contained in that chapter of political economy which deals with the question of the nation's placing to the best use these fruits of her civilization, is one of the highest importance, and is yet to be rigidly applied, for it is still tossed upon the waves of varying opinion created in the minds of men.

During the various stages of development of this principle in our country, the government at different times, and under different influences, has assumed an attitude towards it varying all the way from open hostility to the very verge of that method of treatment employed by King Frederick of Denmark, in the case of Tycho Brahe, three hundred years ago.

Aside from our great problems of education, there stands the equally vital question to us, which may be expressed in its broadest sense as the question of national endowment of research. This is one that naturally resolves itself into two general phases, which are quite distinct. The first is, taken in the light of a productive expenditure, to what extent should the government assist scientific researchers in private life; and, secondly, to what extent should she encourage it among those directly in the government employ.

Touching the first of these questions, I shall have but little to say; and such as it is, is mainly prompted by the aims and purposes of that act which has just passed the senate, known as the 'Blair educational bill.' This provides that the enormous sum of seventy-nine million dollars of money be appropriated from the national treasury for distribution among the states and territories "in that proportion which the whole number of persons in each, who, being of the age of ten years and over, cannot write, bears to the whole number of such persons in the United States." Now, this step not only presupposes that this country claims the right of voting away public means to such ends, but that she actually intends to act upon that supposition. In my own opinion, the nation does hold just such a right; but as well-meaning as the purposes of this bill are, in view of the excellent school advantages all over this country for all classes and conditions, would not the state be equally well served, if not better, by the treasury appropriating a similar sum to be used, by methods now well known to us, towards the development of an American Pasteur, or a Priestley, or another Agassiz, a Longfellow or a Fulton? Has any one any doubt as to which appropriation would advance the national and the people's interest the more? I believe the ends of all education are best met by the latter means of expenditure and endowment. I stand on the side of the king of Denmark, in his principle as applied to Tycho Brahe.

In taking up the remaining side of the question, — i.e., the extent to which the government should recognize and further the researches of those persons in her employ who have from time to time demonstrated their peculiar fitness to perform certain work, — I will, before discussing the subject, formulate a few well-known and established principles. These are as follows: —

1°. Both present and past history teaches us, that, in those rare instances where persons of high attainments, or even genius, have been enabled through government endowment to devote all their energies to their special line of investigation, the result has been of incalculable benefit to mankind for all time.

2°. That one of the inherent characteristics of the pursuit of knowledge is its inability to maintain itself commercially, and that, in all cases wherein the researcher is not financially provided for, it must of necessity be linked with some other occupation.

3°. That the published results of the labors of investigators are only of the highest standard and worth when the investigator has been enabled to pursue his researches with a mind absolutely relieved from pecuniary worry, and an absolute assurance of his being undisturbed, in any way, in the field of his investigations.

4°. That, to make actual progress in learning, the investigator must have the means at his disposal of thoroughly acquainting himself with every thing that has been previously made known by former workers through their published results; then any new facts he contributes in his special calling may be considered as contributions to knowledge.

Aided by these principles, let us now see what the government can effect with her bibliographers who are upon lighthouse duty, anatomists in recruiting officers, bacteriologists in charge of the library, pathologists as ordnance officers, and geologists in charge of the hospitals. There is no question but that the government possesses both the right and the power to apply any one of these distinguished gentlemen to demonstrate the first principle; and will any one question the gain that would follow, to knowledge, humanity, and the nation, by removing the bacteriologist from the library and placing him in the laboratory, where perhaps several thousand dollars' worth of instruments may be awaiting him?

The position of the majority of such scientists in the services fulfils the second principle; and, in any event, the government would have no trouble on that score, as she can retain in her service anyone as long as they please to remain.

It is equally evident that both of the last principles can be carried out by the government with the greatest ease, and without any additional outlay. The pay of any government officer is always sufficient to support him; and we all know that the government lacks neither opportunity, libraries, material, or the power of lifting from off the shoulders of her scientific workers all but the most necessary restraints. Of course, beyond the opportunities afforded by the national libraries, the fulfilment of the fourth principle remains entirely with the scientist himself.

Now, these exceedingly simple requirements are all that is necessary for this government to put into execution, in order to carry out and place in operation the grandest of all social schemes, the most powerful impulse to the progress of knowledge, and

the most complete realization of the ends of all education; yet how rarely is a step ever taken in the direction of putting into execution these four principles, and how often are they violated entirely!

Even to-day, as in years gone by, we find the scientist placed in charge of hospitals full of sick men, and with the lives of women and children in his hands besides, when he can see with his own eyes that every time he is called to attend, as physician, upon the sick, his very presence is detrimental to their recovery, while his painful attempts to demonstrate to those about him that he is trying to do his full duty, only results in total lack of confidence on the part of all the friends, relatives, and attendants, who draw a sigh of relief when he has left the room, and scrutinize his rather vague directions with suspicion.

The same applies to all the other incongruities that I cited above; and examples of every one of them for the last thirty years could and still can be found at any time represented in the government, and in most instances require a radical change, to say nothing of the benefits that would result to humanity for all time. R. W. SHUFELDT.

Fort Wingate, N. Mex., March 14.

The silver problem.

It is generally taken for granted in arguments on this and finance or money problems generally, that the state of business, industry, or economic prosperity, of the nations as they now exist, depends in a very large measure on the substance of which their money is made. Stagnation, crises, and all the baneful consequences thereof, are ascribed to the money system without any intelligent reason.

Money is any thing whose exchange value serves as a standard for measuring the exchange value of other things or of services. It follows that the best money is that whose exchange value is most fixed and unvarying. By a 'survival of the fittest' process, gold now has gained its place as the money best fitted for our present economic system; i. e., the exploitation or capitalistic system.

The customary blunder of the finance tinkers and thinkers is to ascribe the evil results of the present economic system to the money or finance department thereof. This they never do intelligently or clearly, and never can, because that relation does not exist: hence the confusion and general intellectual bankruptcy that prevails on this issue. In the prevailing capitalistic system, money and all other exchange values are permitted to become private property. The producers of exchange values have to give them over to a middleman (capitalist), who compels them to do that by the power of the state, which upholds him therein by upholding him as owner of the means of production. But the producers are by this process exploited (fleeced) by this third party. For example: a shoemaker and tailor would, if free to make their exchange directly, exchange, say, three pairs of shoes for two coats. But the middleman (capitalist) fleeces both by keeping for himself as much as he possibly can of the labor-products of both, without giving any thing in return. He gives the tailor in money the exchange value of only one pair of shoes in exchange for the two coats, and the shoemaker only the exchange value in money of one coat for the three pairs of shoes: consequently, by the hocus-pocus of the money system, he is 'in' one coat and two pairs of shoes. This right to be 'in' is his 'legal' or 'vested' right, — his 'profit.' The producers may deem it a 'vested wrong,' and a great many are beginning to think that way.

Besides being a 'shaving' system, it is also a 'competitive' system; that is, those workingmen get the 'prize,' work and wages, who will live in the meanest and cheapest manner; that is, who work for the lowest price, or, in other words, who will consume the least. The capitalist gets the prize, 'profit,' who has the most integrated and differentiated means of production along with the cheapest labor; that is, who can produce the quickest and most. On one side, the consuming power is decreased; on the other, the producing power is being increased; and in the middle both are fleeced. The result is this remarkably anomalous spectacle of people who are willing to work suffering from want because there is too much produced, and non-producers consuming enormously.

Herein, and not in the money department, is the real 'root of the evil.' Only a remedy that goes to this root, that is, in the root-sense of the word, *radical*, will cure the evil. This remedy is socialism.

CHAS. FIELD.

A swindler abroad again.

A person has been operating in Illinois and Iowa, representing himself to be Prof. H. S. Williams at some points, and Professor Oelrich at others; in all cases, so far as heard from, assuming to be connected with the faculty of Cornell university. His *modus operandi* is to borrow scientific works, money, and paleontological specimens, and contract with colleges to furnish series of fossils illustrative of American geology. He is an expert in classifying fossils, and his method of work is strongly suggestive of the individual who duped many scientific workers last year under the *alias* of Lesquereux. He has worked his games at Galesburg, Ill., Burlington, Mount Pleasant, Ottumwa, and Oskaloosa, Io., being at the latter place March 8 last. He is undersized, a man of from thirty to thirty-five years of age, light hair, beard, and mustache, and apparently having no use of his right arm, though this defect may have been simulated. H. D. CRAWFORD.

Ottumwa, Io., March 18.

Reports of the National academy of sciences.

From inquiries which I have received, there appears to be a general misunderstanding concerning the reports made by committees of the National academy of sciences. It is assumed by the public that these reports have been examined and approved by the academy, and therefore that they express the opinion of that body. This is a mistake. Generally a report is not submitted to the academy for discussion, and it must be understood to represent only the opinion of the committee who sign the report. An example will be found in a late report, published as senate document No. 67 (forty-ninth congress, first session), in which it is recommended to change the beginning of the astronomical day from noon to midnight. Probably a majority of the astronomers of the academy would oppose such a change if they were permitted to speak. ASAPH HALL.

March 18.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 26, 1886.

EDUCATIONAL TENDENCIES IN JAPAN AND IN AMERICA.

IT has for some time past been a cause of wonder that the bureau of education has been able to do so much and so good work with the limited means at its disposal, and receiving but slight recognition from the other governmental departments. Two recent circulars of this bureau will, by their great interest and value, serve to increase this wonder.

One of them deals with education in Japan.[1] The population of the empire in 1882 was 37,041,368, and the school population, comprising all children between the ages of six and fourteen, made up 5,750,946 of this number.

Education is given more official consideration in Japan than here, for it constitutes one of the ten departments of the privy council, and has a minister allotted specially to it. The school organization follows closely the division of the empire for administrative purposes into nine circuits and eighty-four provinces. A school committee is organized in each minor civil division, ward or village; and it conducts all business relating to school attendance, the establishment and maintenance of schools, etc., within its jurisdiction. The tenure of such a committee is not less than four years, and it is composed of men selected by the governor of the province, from a list nominated to him by the citizens of the school district. A committeeman must be over twenty years of age, a property-holder, and a *bona fide* resident of the district from which he is nominated. The directors, librarians, professors, and teachers are appointed and dismissed in various ways, according to the importance of their office. Some are appointed and dismissed by the emperor himself, others by the prime minister on the recommendation of the minister of education, others by the minister of education himself. Their salaries range from 4,800 yen (one yen is equivalent to 85.8 cents) in the case of a rector or a professor of highest grade, to 540 yen or less in the case of an ordinary teacher.

Education has been under government supervision in Japan since 270 A.D., but it was in the years from 1868 to 1871, following the political reform of the country, that it was placed on its present footing. The present educational code only dates from 1880. The school system comprises kindergarten, elementary schools, middle schools, and a university at Tokio. There are also female schools, commercial and industrial schools, and normal schools for the training of teachers. Nineteen libraries and four museums of high rank are under the control of the department. Students are frequently sent abroad to complete courses of study, fifty having been so sent since 1875. Twenty-two such students are abroad at present, seventeen of whom are in Germany. The school funds are raised as part of the national taxes, and the lands occupied by schools are usually government lands: when they do not belong to the government, they are exempt from taxation. In 1881 the educational expenses of the empire amounted to 6,591,878.123 yen, — about 36 per cent of the total expenditure. 8.8 per cent of the entire population were under instruction in 1883 in 30,156 elementary schools, engaging the services of 24,605 teachers, 1,878 assistant teachers, and 64,017 pupil teachers.

The second of the reports to which we have referred is no less replete with information than the former, but from its character it contains more that is suggestive. It was drawn up by the late Charles O. Thompson, Ph.D., of Terre Haute, Ind., and is an essay on technical instruction in Europe.[1]

Into the details of this report space forbids us to enter, but it is a valuable compendium of the system and methods of technical instruction in the various countries of Europe. America is by no means deficient in recognizing the importance of technical schools; but we need to learn all we can on this subject, and call to our aid, when attainable, the experience of other countries, for technical education bids fair to be the education of the future. In our development of free education we have tended to overestimate the dignity of the professions and to underestimate the dignity of the trades. From Germany comes the cry that there are too many educated men, and not enough places for them; and in our large cities we see

[1] *Circulars of information of the bureau of education.* No. 4, 1885. Education in Japan. Washington, *Government*, 1885. 8°.

[1] *Circulars of information of the bureau of education.* No. 3, 1885. A review of the reports of the British royal commissioners on technical instruction, with notes, by the late Charles O. Thompson. Washington, *Government*, 1885. 8°.

hundreds more lawyers and doctors than can obtain a decent living.

The remedy for all this must lie largely in technical education. Teach a trade and the practical application of principles, and inculcate the lesson that no calling is dignified in itself, but it becomes what those who follow it choose to make it. We believe that Professor Thompson's essay is a positive contribution to our knowledge of this subject, and therefore should be carefully studied by all who are interested in education.

NICHOLAS MURRAY BUTLER.

THE CHARACTERS OF CHILDREN AS EVIDENCED BY THEIR POWERS OF OBSERVATION.

THE study of the powers of observation in children has been seldom attempted in a systematic way; and yet, with the tendencies and aims of modern education, there can scarcely be any subject from which might be expected more fruitful results. Professor Farlow, in his recent address before the Society of naturalists, has asserted that the schools, in the last six or seven years, have made no perceptible progress in developing these powers, and that, so far as elementary training is concerned, we are about where we were ten years ago. Furthermore, in his own experience, he finds that the tendency of education, in the lower schools at least, is to impair, rather than to sharpen, the natural powers in this respect. Considering how important an element of successful work, in most careers, this faculty is, one cannot fail to appreciate the value of experiments that may throw light upon remediable mental defects, or upon mental excellences, in childhood.

At the suggestion of Mr. Francis Galton, Mrs. Sophia Bryant, D.Sc., has recently [1] attempted a series of such experiments, the results of which, though subject to fallacies, will point out a fruitful line of investigation.

Her method was the analysis of the characteristics evinced in the description of given objects by a number of school-children, all of whom were of the same age (thirteen years), and unknown to her. For this purpose they were allowed to remain for about ten minutes in a room which they did not know, and were then required to write a description of it. The one first described was a schoolroom, having certain features in common with other schoolrooms familiar to the children, but having certain others peculiar to itself, and a sufficient amount of ornament, in pictures and otherwise, to redeem it from being quite prosaic. The results of her analyses were afterwards compared with the characteristics as given by the children's teachers; from which comparisons, in many cases, striking agreements were found. Of course, in such experiments, as the author rightly says, only repeated and varied trials can eliminate the chances of error; and much less weight should be attached to negative than to positive results. The points thus brought out were as follows:—

1°. In the perception of an object a logical distinction is made between the sense-impression and the apprehension of it by the mind, as between the passive and active factors of perception. Apprehension is essentially the bringing of the new into relation with the old, and thus interpreting the new by means of the old.

In the ratio of these two factors of perception to each other, there were found signs of great variety. Impressions were sometimes numerous and faithful where the power of giving them a meaning, and thus perceiving them fully, was clearly very slight, or at least inoperative. In such cases the perception was what would be ordinarily called unintelligent. In other cases the impressions either made, or at any rate dwelt upon, were fewer, but the apprehension of them was very complete. This completeness of apprehension or understanding occasionally passed beyond the limits of full and accurate perception into pure inference. Sometimes the inference was correct, and that not by chance, since it had the marks of having been cautiously conducted. Such little phrases as 'I suppose,' or 'it is likely,' are tell-tales here, as marking off the cautious from the reckless thinker. This latter person was betrayed also by a very unmistakable hastiness of inference, which in the bad cases degenerated into actual false perception. For instance: the name 'C. W.' in the corner of a picture was reported as 'M. W.,' this being the name of a girl in school whom the young observer knew very well.

It was found, as indeed might naturally be expected, that the false perceivers were nearly always ready apprehenders, who, apparently digressing into actual inference, inferred carelessly, and projected their false inferences into false perceptions. The carelessness of such inference is of a very simple character: the impressions to the test of which the inference should be brought are there, and it is not brought to the test. This argues absence of the impulse to criticise, which is the basis of accurate habits of thought. Feebleness of the impressions is, it must be admitted, a negative cause for the false perceptions, since the test is thus kept in the background; but it is only

[1] *Journ. anthropol. inst. of Great Britain and Ireland*, XV. 338, February, 1866.

a negative cause, since, if the critical impulse were really strong, the inference would be challenged at least, even if it could not be corrected. In judgments, however, as to character-tests, it would be necessary to estimate this negative cause as otherwise indicated, and allow for it before deciding on the degree of the critical defect.

2°. In the second place, differences were observed in the degree of orderliness with which perceptions are marshalled, and in the general notion of order which characterizes any particular observer.

Out of twenty observers, eight gave evidence of no noticeable interest in order at all: the objects appeared to have been observed haphazard, as far as their relation to one another logically, or in place, went. On the other hand, seven descriptions were as orderly as they could well be expected to be; while to three, half marks were given, and to one two-fifths. In most of the orderly descriptions the order chosen was that of place, — the order of the inventory round the room, some starting from the door, some from the opposite point, and some from the clock in the middle. In one or two the order was logical; i.e., the order of what may be called the idea of the room, as in one paper which begins, "The first thing that strikes you are the rows of desks and girls." In another set of papers, describing a more ornamental kind of a room, signs were found of a third kind of order, sometimes very strong, — the order, namely, of aesthetic effects; the order in space, and in idea too, being subordinated to the order in feeling for the beautiful.

3°. Great differences in color-interest were also observable, since some took pains to describe colors fully, while others took no notice of color at all, or very little. In the same way, any marked interest in form was also shown; though in the experiments under consideration no call was made upon the form-interest so strong as to test defect by the absence of response.

4°. One other characteristic, and a most important one, came out into strong relief in a few cases. This is the tendency to substitute feeling for thinking, to apprehend impressions as the minimum of idea with the maximum of emotion, which may be called, for simplicity, over-emotionalism. An over-emotional person perceives objects habitually as sources of feeling; and that is, of course, equivalent to not properly perceiving them at all. Now when, in the description of a room, a child tells you that it is very beautiful, and there are lovely curtains, and the sweetest flowers, and pretty ornaments, it may be considered an evident mark of over-emotionalism, and should, in the educational interest, recommend a wholesome diet of ideas accordingly. The negative defect — for, after all, it is a defect — of under-emotionalism is, like all negative defects, difficult to test; but the freedom from defect reveals itself every now and then in little touches that are very subtle.

In other observations made, a picture was used as a test. The same contrasts as before were to some extent brought out in the various descriptions of the picture; but there was occasion for another set of contrasts in these cases, and these contrasts came out decidedly. To see a picture in the full sense is to understand its meaning, and in the interpretation of meaning there is abundant scope for the most varied play of imagination, whether checked by faithful observation or not. Just as the perception of an object resolves itself into the two factors of impression and apprehension, so the observation of a complex of objects resolves itself into the two factors of perception and explanation by means of appropriate fetches of the constructive imagination. Now, in some children there was found abundant and accurate perceptive detail, with something like the minimum of constructive explanation. In others the opposite extreme was manifest, explanation good, and details little dwelt upon or even described with imperfect accuracy. Between these extremes the two factors were combined in various ratios, including the ratio of equality characteristic of the well-balanced type of mind.

Again, varieties in the nature of the imaginative play, which suggested well-marked contrasts of general character, were observed. Sometimes the play of imagination was almost purely intellectual, strictly subordinated to the purpose of fetching ideas for the explanation of observations. This may be called the logical or intellectual imagination. In other cases the fetch of imagination was not so much after ideas to construe with, as after feelings to luxuriate in: the ideas are overpowered in a mass of vague associated emotion. This, if it can be called imagination at all, may be marked out as the emotional variety; and a touch of it is not, of course, out of place in describing an object like a picture, which has distinct aesthetic bearings. But most striking of all were the examples of dramatic imagination, which were not rare: here the picture is lost in the story which it is interpreted as meant to tell; the picture becomes the occasion for a departure into story-land, instead of remaining, as in the first case, the main fact, solely for the explanation of which such departures are at all allowed, and by which they are limited. Besides these marked cases, there were doubtful cases, and cases negative altogether. Sometimes, too,

the play of imagination was markedly careless, and uncontrolled by the inward critic, as compared with the good cases in which it showed itself sober and self-controlled.

As the author says, the sources of error in such observations as these are very numerous; but from repeated observations by many observers, carefully collated, these errors may be in a great measure eliminated, and substantial results arrived at, of whose practical bearing there can be little doubt.

OBSERVATIONS UPON DIGESTION IN THE HUMAN STOMACH.

DIRECT observations on digestion in the human stomach have been very seldom made, as opportunities for such cannot often occur. Those by Beaumont many years ago are familiar to every student of physiology, and, notwithstanding their lack of completeness and their many imperfections, they served a very useful purpose in explaining many of the processes whereby digestion is affected in this organ. These observations have been supplemented by others; but the results of modern physiological researches have been such, that renewed opportunities to make such direct observations must be of great value. Such a one occurred within the past year in the person of Heinrich Baud, a healthy young man twenty-eight years of age, into whose stomach, in consequence of a stricture of the oesophagus that prevented the passage of all food, a surgical opening five centimetres in length was made. The case passed into the hands of Mr. A. Herzen, the well-known physiologist, who improved the opportunity to make a series of experiments upon the digestibility of certain foods and upon the behavior of the gastric juices (*Kosmos*, 1885, ii. 1, 4). The pepsin secreted by the patient was of unusual quantity, and, what has hitherto never been observed in similar cases, or through the artificial fistulas of dogs or other animals, there was a changeable but often considerable quantity of bile present. These circumstances, however, though complicating the experiments, did not especially affect the results.

The author's methods of experimenting were as follows: a substantial meal was given to the patient at 7 o'clock in the evening, and nothing further was permitted to enter his stomach till the next morning, when experiments at 6 o'clock were begun, first upon the empty organ. After an examination of the juices therein contained, there was introduced the albumen from three hard-boiled eggs, with two to three hundred grams of water, together with three small silken nets, each containing eight small pellets of albumen, uniform in size, and regular in shape, and which could be easily withdrawn for examination. These observations through the fistula were made hourly, and one of the nets with its contents removed.

Remarkable and unaccountable conditions were found in which the albumen remained one or even two hours in the stomach without undergoing any perceptible change, notwithstanding the presence of ferment, with which it was impregnated. In these cases the albumen pellets usually retained in their substance precisely the requisite quantity of pepsin for their solution, which, under favorable circumstances afterwards, exactly sufficed to digest them. This furnishes evidence that the pepsin does not act through simple contact alone, and that a given quantity of it can dissolve only a given quantity of albumen, and that consequently the pepsin, by the exercise of its digestive activity, loses its entire potency.

Observations directed toward the ascertainment of the time required for the stomach-juices to impregnate coagulated albumen showed that they penetrated about one millimetre during the first hour and three millimetres within the second. It was also learned that the acids were much more active than the pepsin in penetrating the substance. This last fact furnishes a new proof of the presence of a free acid in the stomach-juices. The juices, however, at such opportunities as it was possible to examine them, were sometimes found to be of a neutral reaction. But, in order to test the action of acid and ferment further, he introduced at times a quantity of soda to neutralize the acid; without, however, materially affecting the activity of the pepsin, although it appeared to somewhat diminish it. It therefore results that pepsin exerts its digestive power almost wholly independently of the acid. The reverse of this, as may be expected, was also found true, — that the acids penetrated the albumen in the absence of the pepsin, and, when the pieces of albumen were small, a sufficient quantity was absorbed to digest them.

Another series of researches was made upon the fluids of the stomach, from which it was found, that, on the mornings after fasting, the secretion usually was small, while at such times following the ingestion, during the night, of milk or any fluids containing alchohol, the secretion was greater. During the first hours of digestion the quantity held a definite relation to the volume of substances introduced, while in the fifth hour the quantity was always more abundant, about three or four hundred grams. The first secretion of the morning was in general a somewhat thick, very stringy, more or less clear fluid, which resembled the white of an egg; that obtained during the

process of digestion was less thick and less stringy; while that of the fifth hour was turbid, thin, and little or not at all stringy.

Of the hundred and forty-two specimens examined, one hundred and seven showed a yellow or green color, more or less intense, and which indicated the presence of bile. It is worthy of note, that, despite the almost constant presence of bile in the stomach, the digestion was not perceptibly disturbed, and analyses of the contents of the stomach during different hours of digestion clearly proved that the activity of the fluids was not impaired by its presence. It was also observed that the entrance of bile into the stomach partook of a sort of periodicity, a less quantity being found during the first two hours of digestion than at the time either before or after, and that the quantity was still less during active digestion, when fluids, especially beer, were taken in.

The hydrochloric acid of the juices during digestion was found, in a mean of eighty-seven examinations, to be from 1.8 to 1.9 per cent in weight of the entire quantity, — a somewhat higher percentage than that given by Richet. The acidity gradually increased during the first hours of digestion, reaching its maximum at the third hour, from which time it gradually decreased. A few times the juices were found neutral, and the highest acidity attained was 4.2 per cent.

Since Dr. Koch has shown that an acidity equivalent to two per cent of the gastric juices suffices to destroy the cholera microbe, it has been recommended that table-salt should be employed during cholera epidemics to increase the quantity of acid in the gastric juice, and thus prevent the entrance of these germs into the alimentary canal; but from a series of experiments it was ascertained that the direct reverse was the result, and that the larger the quantity of salt introduced, the more considerable and permanent was the decrease of the acidity, so much so that at times the juices were rendered entirely neutral. Contrary to the opinions which have been expressed by physiologists, that salt increased the activity of the secretion of pepsin, experiments seemed to prove that it hindered such secretion, and when large quantities were taken, either into the stomach or by injection, the stomach digestion was most impaired. Mr. Herzen, however, would by no means deny the probability that salt injected directly into the blood increases the secretion of pepsin. On the other hand, it was established that the introduction, either by the stomach or the rectum, of some good peptogenic substance, such as broths or dextrine, uniformly hastened digestion in the stomach, and that this resulted independently of the increase of acidity, and despite the frequent presence in the stomach of the contents of the duodenum. In other words, the digestion may be hastened, and a richer secretion of pepsin brought about, by their use; while others, such as tea, wines, and grape-sugar, produce no effect whatever. Of the practical results of such observations, corroborating and adding to, as they do, conclusions previously and in other ways arrived at, there can be no doubt. Those who would aid an impaired digestion may seek in certain foods, such as broths, stale bread, milk or coffee, taken a while before regular meals, efficient helps; while alcoholic drinks, and especially the sour wines, sugars, and others, may be not only of no use, but even actually prejudicial. To the child and the invalid the results are no less useful.

BLINDNESS IN RUSSIA.

AT the first congress of Russian doctors, which was held in January last, many important papers were read, followed by discussions of considerable interest, some of the most eminent members of the profession from the different provinces and universities of the empire taking part in them. A very striking contribution to the study of social and sanitary questions, says the *Lancet*, was afforded by a paper by Dr. A. T. Skrebitski, on the 'Distribution and statistics of blindness in Russia.' The data employed were chiefly those collected by the military authorities who have to examine young men as they become liable to service in the army. Taking the total for the five years 1879 to 1883, the number examined was 1,388,761, of whom 13,686, or almost one per cent, were blind in one or both eyes. In certain districts the proportion was much higher than the average; and some of the largest, or rather most populous, provinces seem to have presented the greater proportion of the blind: thus in that of Kieff, which sent up almost the largest number of recruits, — namely, 43,118, — no less than 660, or 1 in every 65, were found to be blind in one or both eyes. The smallest proportion of blind was found in Archangel, where it was 1 in 390; but even this is far above the proportion in other European countries.

To make the comparison with the statistics of other countries, it is necessary to subtract the number of those blind in one eye, which in Russia is found to be only a fifth of the total blind: thus, we may consider that four-fifths of the 13,686 recruits returned as blind were blind in both eyes, so that the ratio of totally blind is about 1 to 125. The ratio in England and Ireland is 1 to 1,015, and that in several other European coun-

tries is still lower, being 1 to 1,406 in Saxony, and 1 to 1,429 in Denmark. Dr. Skrebitski's paper attracted a considerable amount of attention from the lay press, the *Novosti* remarking, "We have surpassed Europe not only in mental but in physical blindness." To any foreigner, however, who reads the Russian medical journals, the valuable original communications with which they literally teem would appear to indicate the reverse of 'blindness,' in the Russian scientific world at all events.

BANCROFT'S HISTORY OF ALASKA.

THE history of Alaska, up to the time of the American purchase, has two divisions into which it naturally falls, — the period of independent Russian traders, fighting and competing on every hand; and the period of organized monopoly, which succeeded that competitive anarchy. Explorations of a rude sort, the vices of the semi-civilized Cossacks, and the rage for wealth represented by sea-otter skins, went hand in hand. A myriad of petty traders, bold, energetic, lustful, and avaricious, after the return of Bering's expedition, swarmed upon the Aleutian Islands, trading, hunting and robbing the natives, occasionally being slaughtered in return.

Of this period, with the causes which led to it, and its consequences for Russia and for America, Mr. Bancroft gives an extremely full and almost interesting account. Parts of it are dramatic; but the annals of so many petty expeditions with the same object, and almost always substantially similar results, cannot but be rather monotonous. Though much of the material is of only approximate accuracy, and derived from scattered and unverifiable copies of old records long destroyed, Mr. Bancroft has given what would seem to be by far the best account extant, and one not likely to be improved upon.

Of the second period we have also a remarkably full and acceptable account of the formation, fortunes, and fate of the monopoly known as the Russian American company, and of Alexander Baranoff, the man of all others characteristic of the Russian occupation of Alaska, the Peter the Great of the territory. Of history in its widest sense, the grasp of underlying motives, — the reaction of European politics, the growth of the United States, and other large forces upon the springs which governed events on the north-west coast, — there is little: the volume is rather materials for history, than history. But it is for he Russian period a very full, and in the main sufficiently accurate, chronicle of events. Of the period succeeding the purchase (a much more difficult task) less can be said in praise. A similar division of this epoch will by its future historian be found applicable. The era of violent and unrestrained competition in this case, however, lasted only two or three years; while the monopoly which succeeded, though more confined in scope than that of the Russian company, does not differ in its essential characters, and is still in operation. The chronicle of events since 1867 is full, but by no means complete. The scientific investigations, which have been a marked feature in the recent development of the territory, are very unequally treated, and many of them pass with a bare mention; others are ignored altogether; while a disproportionate space is given to the petty affairs of the trade-monopoly above referred to. There are numerous errors of detail; and the just reprobation of misgovernment and lawlessness, which the (mostly foreign) fur-traders under American sovereignty should share with the still viler authors of the early Russian trade, seems to have been reserved for the former in unreasonable proportion. This period, however, is so much nearer the historian, so many of the actors in it are still in the active pursuit of their business, and the passions and prejudices engendered by recent rivalry are still so hot, that historical impartiality is not to be expected.

Mr. Bancroft recognizes the wealth of the territory, and gives an excellent account of its hardly touched resources, other than the fur-trade. He very justly and severely criticises the inaction of congress, which has left the territory at the mercy of law-breakers for more than fifteen years, has only recently accorded a merely nominal and almost impotent form of government, and in the past has saddled upon the inhabitants, in lieu of the law they had a right to, a succession of corrupt or inefficient petty officials. The book has an excellent index, and numerous small sketch-maps in the text. The general map of the territory is bad, out of date, and in nomenclature discrepant with itself and with text, beside containing several inexcusable and wholly original blunders.

History of Alaska, 1730-1885. By HUBERT HOWE BANCROFT. San Francisco, *Bancroft*, 1886. 8°.

OCEANA.

SIR ARTHUR HELPS once said that when Lord Palmerston was forming a new ministry, not so very many years ago, he was at loss for a colonial secretary. This name and that was suggested, and thrown aside. At last the noble lord said,

Oceana; or, England and her colonies. By JAMES ANTHONY FROUDE. New York, *Scribner*, 1886. 8°.

"I suppose I must take the thing myself. Come up stairs with me, Helps, when the council is over. We will look at the maps, and you shall show me where these places are." It occurred to Mr. Froude that it would be a good thing not merely to find out where the colonies were, but to make a tour among them, to talk to their leading men, see their countries and what they were doing there, learn their feelings, and correct whatever erroneous impressions he himself shared in common with his countrymen. He sailed for Melbourne in the beginning of December, 1884, in the new steamship Australasian; and on the 16th of May, 1885, he landed at Liverpool from the decks of the Etruria, on her first return vogage from New York. In this volume the events of that trip around the world are most charmingly narrated.

His first encounter, however, was with an inhabitant of an island much nearer Downing Street than New Zealand. He thus narrates the incident: "I saw an Irishman in the unmistakable national costume, the coat-seams gaping, the trousers in holes at the knees, the battered hat, the humorous glimmering in the eyes. I made acquaintance with him, gave him a pipe and some tobacco, for he had lost his own, and tempted him to talk." The man, who had probably never heard of Mr. Froude or his books, opened his heart to him. After describing how the Manx men had come down and taken all the herring in his neighborhood (for it seems that he was a fisherman), he went on: "And then there was the bit of land"—here he paused a moment, and then continued, "Thim banks was the ruin of me. I had rather had to do with the worst landlord that ever was in Ireland than with thim banks. There is no mercy in them. They'll have the skin from off your back." Poor fellow! No sooner had he got fixity of tenure than he had borrowed money on the strength of it, and the result was emigration to the antipodes. "How many hundreds of thousands of his countrymen will travel the same road?" queries our author.

A few hours only were devoted to the Cape of Good Hope; for Mr. Froude had sojourned there ten years before, and had seen all of the misgovernment of that colony that he desired. Adelaide was merely glanced at, but a long and interesting visit was paid to Melbourne and Sydney. A trip was taken to Ballarat, Bendigo, and other points in the interior of Victoria. Everywhere he was well treated, and everywhere he saw nothing to blame and much to praise. He was in a land where patriotism was not "a sentiment to be laughed at—not, as Johnson defined it, 'the last refuge of a scoundrel,' but an active passion." He predicts a glorious future for Australia. People wrote to him afterwards that he had purposely been shown the bright side of things, "that we let ourselves be flattered, be deluded, etc. Very likely. There was mud as well as gold in the alluvial mines. The manager pointed out the gold to us, and left the mud unpointed out. The question was not of the mud at all, but of the quality and quantity of the gold. If there is gold, and much of it, that is the point. The mud may be taken for granted." Rather a dangerous method of investigation, one would say, and a method the pursuing of which has destroyed much of our faith in Mr. Froude's deductions.

He next passed over to New Zealand, this time in an American steamer. But though the captain and the steamer were American, the crew was not. Indeed, our author, puzzled to make out what they were, asked the captain how he had picked them up. "I make a rule," the captain replied, "to take no English, no Scotch, no Irish, no Americans. They go ashore in harbor, get drunk, get into prison, give me nothing but trouble. It is the same with them all, my people and yours equally." He preferred Danes, Norwegians, Germans, Swedes, and Chinamen. It took five days to make the voyage from Sydney to Auckland. Then followed a month mainly devoted to sightseeing in the wonderful volcanic interior of the North Island. This part of the book is well illustrated, and we remember no better description of the last retreat of the Maori. In fact, it makes one wish that the author had devoted more of his time to descriptive writing, and less to historical dissertations.

From Auckland he voyaged to San Francisco *via* Honolulu. It is always pleasant to hear one's country and countrymen praised, and Mr. Froude has been by no means stingy of praise when speaking of us. "The Americans," he declares, "are the English reproduced in a new sphere. What they have done, we can do. The Americans are a generation before us in the growth of democracy, and events have proved that democracy does not mean disunion." But all the desirable results were not brought about by the spirit portrayed in the following sentence. He has been speaking of the scheme for a real imperial parliament (something akin to our congress) to take charge of the 'foreign and colonial policy' of a federated British empire,—Oceana,—and says, "Of all the amateur propositions hitherto brought forward, this of a federal parliament is the most chimerical and absurd." Why? it may be asked. Because the English house of commons is omnipotent, is the reply. "Who is to persuade it to abdicate half its functions, and construct a superior

authority which would reduce it to the level of a municipal board?" It may be safe to say, that, until the English house of commons does consent to divide its authority with some kind of a legislative body in which the Englishmen who happen to live in Canada and Australia shall have a voice, every scheme for an 'Oceana' will prove 'chimerical and absurd.'

MINOR BOOK NOTICES.

New theories of matter and force. By WILLIAM BARLOW. London, *Sampson Low & Co.*, 1885. 8°.

MOST theorists, in seeking to escape from the difficulties in the way of an adequate conception of the luminiferous ether, would hesitate to embrace a theory which involved either the denial of the conservation of matter or the acceptance of the emission theory of light; and yet the author of 'New theories of matter and force' has no craven fear of either or both of these conclusions. Ordinary matter, he conceives, is a mixture of two hypothetical ethers in a highly condensed state. The properties of these ethers are peculiar. Both have inertia, and, when unrestrained, expand indefinitely like gases. One is more compressible than the other, and cohesion in each is proportioned to the density. To avoid all appearance of action at a distance, this cohesion is not supposed to be an attraction, but rather a clinging-together of contiguous particles. This seems to require these ethers to be continuous; but this is no serious embarrassment to our author, who finds no difficulty in reconciling perfect continuity of substance with any desired degree of compressibility. Owing to the diminution of the cohesion with the density, these ethers have the remarkable property that the expansive force increases as the volume becomes greater. By means of these two ethers we have the fundamental machinery for the complete explanation of matter, gravitation, light, heat, and electricity. The greater part of the book is devoted to the application of the theory throughout the whole realm of physics, supplementary hypotheses being courageously introduced when necessary. The main phenomena of light are explained by a combination of the wave and emission theories, as interpreted in the light of two ethers. It is much to be regretted that the author, before publishing his theory, did not subject it to a scrutiny at least as rigid as that which led him to reject the accepted views. The scientific imagination has an important use when stimulated by knowledge and guided by reason; but before we lightly cast aside those theories which are the result of the most profound thought, not of one mind, but of many, and which have been slowly elaborating during patient years, and set up in their stead our own brief conceits, we may well pause and consider.

The determination of rock-forming minerals. By Dr. EUGEN HUSSAK. Translated by Dr. E. G. Smith. New York, *Wiley*, 1886. 16°.

THIS is a work of which we cannot speak favorably. Dr. Smith's evident lack of acquaintance, both theoretical and practical, with the subject, has compelled him to make a close literal translation from the original; and, as would be expected, numerous errors have thus crept in, in addition to the many in the original. The whole spirit of the German language is such that close translations of technical works are rarely happy in their results — certainly never, except when one is most thoroughly familiar with both the language and the subject under consideration. It is very much to be doubted whether Dr. Smith possesses either of these qualifications; otherwise he would never have made such errors as 'the entrance face of the light' (*eintrittsfläche*) for 'plane of incidence,' and 'shell-formed' (*schalenförmig*) for 'zonal.'

Along Alaska's great river. By FREDERICK SCHWATKA. New York, *Cassell*, 1885. 8°.

THIS excellently illustrated volume describes the journey of Lieutenant Schwatka's exploring-party from Portland, Ore., through the beautiful inland passage along the north-west coast of America, as far as Sitka in Alaska, thence overland to the head waters of the Yukon River, which was explored with considerable accuracy by his expedition as far as Fort Yukon. Schwatka's raft-journey down the Yukon, and his explorations in that region, have been often referred to in these columns. Capt. C. W. Raymond, of the engineer corps of the army, had surveyed and charted the Yukon River from Fort Yukon to its mouth, about a thousand miles, as early as 1869, and Schwatka pays a deserved tribute to the accuracy of that officer's work. In fact, the large chart of reference accompanying the volume appears to be a reduced copy of Raymond's chart, which is said to be the best in existence of that part of the great river. It is to be regretted that Schwatka's time for this exploration was limited to one short summer, and that his arrival at St. Michael's had to be so arranged as to anticipate the departure of the last vessel going south from that point in the fall. Otherwise it is almost certain that he would have explored a much wider region, thus adding much to our knowledge of that almost unknown American territory.